CWM-MEMO

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GUIDELINES FOR IMPLEMENTATION TARGETS 1.0

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1. INTRODUCTION

The modelling activities for TARGETS 1.0 draw near the last phase. To derive one fully integrated model which is transparent and readable, of which the style of implementation, the mathematical formulation of the different sub-modules and the assumptions made, to be uniform and consistent as possible, some guidelines for implementation and documentation are made.

2. QUALITY MANAGEMENT

2.1 DOCUMENTATION

TARGETS itself and the studies using TARGETS will be documented in several ways. Henk Hilderink, Marco Janssen and Pim Martens will coordinate the concretisation of the different forms of documentation. We distinguish the following forms:

-*Technical Documentation*

The source code of submodels according to the model implementation guidelines as discussed in section 3.

- *GLOBO working paper*

This is not an official report or publication. It is a document for internal use only.

- *GLOBO report*

This is an official RIVM report

- *articles in scientific journals*

- *GLOBO newsletter*

Newsletter of GD & SD project contains the latest developments of the project and illustrative case studies. Will appear every quarter of the year.

- *GLOBO@rivm.nl*

The general e-mail address for information about the GD&SD project will be: GLOBO@rivm.nl

- *GLOBO-mosaic*

Public domain area of GD&SD group.

- *Poster*

2.2 SAFE MODELLING

Back ups TARGETS Source Code

A back-up of all TARGETS source code will be made:
- every day
- every month, which will be kept in a safe
- every year, which will be kept in a safe

Back ups Documentation

A copy the wordprocessor file of every publication (GLOBO newsletter, GLOBO working paper, GLOBO report, article) will be stored centrally.

3. MODEL IMPLEMENTATION

This session is partly based on the guidelines for implementation of the integrated model for public health (Vrijsen, 1993).

3.1 Organisation

Time parameters:

The TARGETS model simulates the state of the world on a yearly basis. Within the model there are several global defined time variables. The default time step is one year. Other global defined time steps available are

TM : timestep of 1/12 (month)
TS : timestep of 0.25 (season)
TH : timestep of 0.5 (half year)

Because of numerical (in)stabilities or time consuming operations the size of the time step can be changed. Therefore modules, processes and variables may use different time steps which choice has to be fully tested on the numerical preciseness of the solutions.

For geographical representation of data a time step of 10.0 has to be used.

```
T.MIN = 1900.0;
T.MAX    = 2100.0;
T.STEP   = 1.0;
T.SAMPLE = 1.0;
T.METHOD = RK2;
```

Each module has to be defined in a separate file. The name of the file is equal to *name of the module (version number).m* (for example: human3.m)

3.2 Name-giving

To make a clear source-code the commandos of the M language has to be written in CAPITALS.

3.3 Build-up of source code

To improve the readability of the source code of TARGETS and to derive a uniform outline the following guidelines for the implementation has to be followed.

All information within the source code has to be written in English.

MODULENAME

Name of the module

MODULE DESCRIPTION

Short but complete description of the module.

REFERENCES

References for a more comprehensive description of the module and perhaps models on which this submodel is based on.

UPDATE HISTORY

An overview of the main steps in the development of the module. Include the name of the developer, a description of the change, the data and the version number of the module.

MODULE DEFINITION

Specification of the module statement. The name of the module starts with a capital.

INCLUDE LOCAL STATEMENTS (MODULES USED)

Inclusion of used models which is used local.

MODULE INSTANTIATIONS

Declaration of all modules with whom will be communicated within the module. The name of the instantiation is written in small characters.

IMPORT/EXPORT VARIABLE DECLARATIONS

Declaration of IMPORT and EXPORT variables.

MODULE CONNECTIONS

Declaration of all communication lines between this and other modules.

DEPENDENT VARIABLE DECLARATIONS

Declaration of local variables. For all variables the meaning and unit has to be given. If possible, an uncertainty range has to be given for constants. Furthermore, the variables which are important for calibration (parameters, observable variables) have to be declared in a separate box above the other variable declarations.

PROGRAM SOURCE CODE

The equations of the model in a logical order according to the cause-state-impact system.

4 PRODUCTS

Project leader of `Global Dynamics and Sustainable Development' is Jan Rotmans. The development of the integrated model TARGETS is the core of the project, next to related studies which mainly are focused on the use of models. In this session the sub projects are discussed briefly, in the sense of expected products this year and an overview of the main researchers.

4.1 TARGETS 1.0

For every part of the TARGETS model the main developers, the present state, lacunas and TARGETS 0.9 and TARGETS 1.0 version will be described briefly.

Integration
Coordinator: Henk Hilderink
Other Researchers: Marco Janssen

Population and Health model
Coordinator: Louis Niessen
Other Researchers: Henk Hilderink
Pim Martens
Marjolein van Asselt
University of Groningen

Present state:
5 age classes
2 sexes
12 exposure categories
10 single disease categories
8 double disease categories

TARGETS 0.9:
- data collection
- income distribution
- response/investments
- skin cancer
- implementation and calibration of fertility model
- calibration

TARGETS 1.0:
- effects of toxic chemicals on health

Energy and Resources model
Coordinator: Bert de Vries
Other Researchers: Ruud van den Wijngaart
Marco Janssen
Hessel van den Berg (trainee)

Present state
- Model is implemented in Stella
- 6 fuels
- 2 minerals
- A pilot study on Input/Output analysis by Fay Duchin (IEA) is in preparation

Lacunas- Economic model: the present version is a simple aggregated model based on World 4.0. A pilot study on a simple I/O approach is in preparation. Implementation of a general economic model will not be taken up in the TARGETS 1.0 version because of existing economic models are regionalized, not formulated in a system dynamic framework and there is no consensus about which type of economic model will fit the best within TARGETS. Therefore a formal economic model will be developed in the next state.

- The present energy and resource model is an expert model and is formulated in a somewhat more advanced way than other parts of the model. To keep the balance between the different submodels the energy and resource model might be restructured in the way other models of TARGETS are formulated.

TARGETS 0.9- Calibration and validation of the energy model for the United Stated of America
- Calibration on a world level
- Implementation in M

TARGETS 1.0 - I/O model
- restructuring and recalibration energy and resource model.

AQUA

Coordinator: Arjen Hoekstra
Other Researchers: Resource Analysis

Present State:11 water-reservoirs
12 landtypes
4 quality classes
1 pollutant

Lacunas:
- inconsistencies with land model (landtypes/(season) temperature, North/South versus temperature/tropical, LGP estimation, irrigation cost)
- inconsistencies with energy model (depletion and learning, hydro-power)

TARGETS 0.9:- distribution function precipitation, ground moisture, concentration water pollution
- quality levels
- Calibration

TARGETS 1.0:- Validation model for case studies on Ganges/Brahmaputra and the Yangtze.
- water quality

Land model
Coordinator: Michel den Elzen
Other Researchers: Heko Koster
Pim Martens
Jodi de Greef
Mark Heijl (trainee)

Present State 9 crop types
3 productivity classes
12 land types

Lacunas: - inconsistencies with AQUA (landtypes/(season) temperature, North/South versus temperature/tropical, LGP estimation, irrigation cost)
- linkages with element cycles and energy & resources

TARGETS 0.9: - Calibration

TARGETS 1.0: - Erosion model

Element Cycles
Coordinator: Michel den Elzen
Other Researchers: Dick van de Meent (GLOBOTOX)
Eric Verbruggen (GLOBOTOX)
Martijn Root (trainee)
Michel Bakkenes (trainee)

Present StateC and N cycle
simplified P and S cycle
climate system
ozone model

Lacunas: linkages with land model, energy and resources model and AQUA

TARGETS 0.9: - parameterization S cycle
- initialization oceans
- calibration

TARGETS 1.0: - soil model (including acidification, toxics and heavy metals)
- GLOBOTOX

Steering System
Coordinator: Marco Janssen

Other Researchers: Marjolein van Asselt

Present State No general set up of a steering system.

TARGETS 0.9: - general framework steering system based on priority approach.
- example worked out for population and health system

TARGETS 1.0: - general framework applied on TARGETS in a simple way.

4.2 RELATED PROJECTS

Global Environmental Strategic Planning Exercise (GESPE)
Coordinator: Bert de Vries

Further improvement of policy exercise for the climate change issue on the context of regional and international demographic and economic developments. Testing the feasibility of GESPE by organisation of a workshop and explore ways to structure the learning environment (more) adequately.

Visualisation
Coordinator: Jos de Bruin
Other Researchers: Pascal de Vink
Jack van Wijk (ECN)
Ester Mosselman

- Visualisation sessions TARGETS
- Proposal for improvement graphical user interface (MGUI)
- Proposal for the user interface and user support system of TARGETS

M
Coordinator: Jos de Bruin
Other Researchers: Pascal de Vink
Jack van Wijk (ECN)
Michel Bakkenes
Marco Zwetselaar

- Report of the simulation language M
- Manual for the simulation language M
- Manual for the graphical user interface (MGUI)
- availability of UNCSAM within M-environment

PC-TARGETS
Coordinator: Radek Zapert (WRI)

Other Researchers: Paul Gaertner (USA)
Marco Janssen

Henk Hilderink

- Efficiency analysis of the implementation of TARGETS 0.9 and reprogramming several submodels.
- Stand alone version of several submodels on the PC (486) (Coordination with M-development group)
- Start of metamodelling.

Uncertainty Analysis
Coordinator: Marjolein van Asselt
Other Researchers: Henk Hilderink

- GLOBO report `Alternative Model Routes'
- A tested version of UNCSAM application within the M environment

Response Strategies
Coordinator: Marco Janssen

Working paper of a case study: `response strategies for climate change'

Complex Adaptive Systems
Coordinator: Marco Janssen
Other Researchers: Jodi de Greef
Henry van den Bedem (trainee)

Pilot study: Inventarisation of the field of complexity theory and complex adaptive systems. Preliminary results of case studies on application of adaptivity on, for example, the carbon cycle and ecosystems.

Indicator-system
Coordinator: Arjen Hoekstra

Framework of indicators for TARGETS, also apart for the human system and the environmental system

5. PLANNING

This planning is mainly based on the Mitland sessions on July 8, 13 and 15, 1994.

August/September Calibration and testing TARGETS 0.9

October GLOBO newsletter 1

Technical documentation TARGETS 0.9 according to cwm-memo

GLOBO Working papers:
- Population and Health model
- Energy model
- Land model
- Element cycles
- AQUA
- Alternative model routes
- Schistosomiasis
- Erosion

November stand alone versions of soil model, erosion model and GLOBOTOX

indicator framework

December Fully integrated version TARGETS 1.0

REFERENCES

Rotmans, J. et al. (1994), `Global change and sustainable development: a modelling perspective for the next decade', RIVM-Report no. 461502000, Bilthoven, The Netherlands.

Vrijsen, W.J.J. (1993), `Modelstructuur en implementatie richtlijnen voor versie 1.0 van het integrale model van de volksgezondheid', CWM-memo 017/93, Bilthoven, The Netherlands